## REMARKS

### I. Interview

Applicant and the undersigned Attorney wish to thank the Examiner for the courtesy of the interview of June 24, 2002. A summary of the interview is set forth in Form PTO-413.



### II. The Claimed Invention

#### A. "Blending"

In accordance with the claimed process, a first stream of water is passed through an ion selective membrane to form a softened water having a reduced content of hardness ions. This first stream of softened water is ***blended*** with a second stream of untreated water containing a higher concentration of hardness ions than the softened stream to form a feed to a desalination system. The blended feed is then introduced to the desalination system to form a water product of potable quality. Support is found in the paragraph bridging pages 2-3 of the specification, page 11, lines 2-12; Table 7; and Figures 1-3 and 6-9.



#### B. Unexpected Superior Result

It was unexpected that the use of a blended feed as make-up to a desalination process, rather than the use of 100% of softened water, did not have a negative impact on yield and the ability to achieve top brine temperatures (TBT) of $\geq$ 120°C. As shown by Tables 8-11, it is possible to obtain a commercially viable TBT of 121°C with 10% NF make-up and a TBT of 125°C with 20% NF make-up. Figures 7-9 illustrate variable blends at a TBT of 120°C, 125°C and 130°C, respectively. This achievement is contrary to the prior art which teaches that 100% NF make-up is required to obtain a TBT of a $\geq$ 120°C. Advantageously, therefore, the claimed invention provides a process wherein only a portion of the feed must be treated. This translates

into a more cost-efficient operation of desalination plants and a reduction of the energy consumption of such plants without sacrificing yield or TBT. (See, page 2, lines 14-26).

**III. Claim Rejections – 35 U.S.C. §102**

Claims 1, 3-8, 11-18 and 24-29 are rejected under 35 U.S.C. §102(a) as being anticipated by WO 99/16714 (hereinafter "Hassan").

Hassan is directed to a hybrid process for the desalination of sea water. This hybrid process consists of combining nanofiltration technology with basic desalination processes. In accordance with Hassan, sea water is passed through a membrane nanofiltration unit to form a first water product having a reduced content of ionic species, microorgansims and particulate matter. Thereafter, ***100% of the softened water product is used as the make-up or feed to a desalination system***. There is no disclosure or suggestion by Hassan that a blend or variable percentage of make-up would advantageously improve the performance of desalination plants. Hassan is discussed in the specification at page 2, lines 1-11 and at page 7, lines 2-14.

Applicant submits that the process of Hasssan is suggested, if not disclosed, by the prior art publication Wensley, A.G., et al., "Ion Selective Membranes: A Presoftening Process for Seawater Distillation", Proceedings of the 7th International Symposium on Fresh Water from the Sea, vol. 1, pp. 417-426 (1980) ("Wensley"). A copy of the Wensley publication is being submitted as part of Applicant's response to the Office Action. The Wensley publication is cited as a reference of US 4,723,503 issued February 8, 1988 to Plummer which is discussed in the subject application at page 1, lines 27-32. Wensley provides the following:

> A membrane process can be used for presoftening of the feed for seawater distillation, if membranes are used which have a high rejection of divalent ions, combined with a high salt passage for

> univalent ions. Laboratory data for several membranes indicate the feasibility of such a process. (Abstract)

It should be noted that while Wensley may suggest and/or disclose the process of Hassan, neither Wensley nor Hassan disclose the claimed process and advantages of using a blend or variable percentage of make-up to a desalination system. In contrast to the claimed invention, Wensley and Hassan disclose that 100% of the feed is presoftened before passing to the desalination system.

The Examiner's attention is directed to Figure 2 of Hassan. At page 6, lines 15-16, Figure 2 is described as a schematic flow diagram of an NF-SWRO desalination plant of the Hassan process. However, Figure 2 also shows the combination of NF and MSF. In any event, Figure 2 illustrates a process wherein seawater is subjected to nanofiltration treatment to produce a NF-permeate consisting of softened water. Thereafter ***100% of the softened water product is used as the make-up or feed to MSF or RO***. There is no suggestion in Figure 2 of blending streams of variable concentrations of hardness ions to form a blended feed to MSF or RO.

Applicant submits that the disclosure appearing in Hassan at page 20, lines 16-17 must be read in view of Figure 2. Therefore, when Hassan states that "[t]he NF permeate can thus be used as make-up feed to the MSFD step in a combined NF-MSFD process", there is only one legitimate interpretation in view of Figure 2, i.e., that ***100% of the NF permeate is used as make-up feed to the MSFD step***.

Furthermore, Figure 9 of Hassan is a schematic flow diagram showing a plant employing the concept illustrated by Figure 2. Accordingly, Figure 9 shows a NF unit as a first desalination step feeding SWRO and MSFD as the second desalination step. The same figure shows SWRO reject as feed to the MSFD step. The portion of Figure 9 regarding the MSFD step shows a

conventional MSF plant with its component parts, e.g., BH (brine heater), H.RC. (heat recovery), H.RJ. (heat reject), A/A (deaerator), etc. There is no suggestion in Figure 9 of blending streams of variable concentrations of hardness ions to form a blended feed to MSF or RO. Rather, the feed entering the MSF, RO or hybrid RO-MSF desalination systems is100% NF permeate. For clarification purposes, the S.W. (sea water) passing through the H.RJ. (heat reject) section of the MSF is not mixed or blended with the NF permeate or SWRO reject. The S.W. (sea water) is merely passed through the H.RJ. (heat reject) section as a coolant and then exits the system.

The general system of Hassan, as discussed above, is the same concept disclosed in JP 9131260 (11/1995) which was previously cited by the Examiner. In accordance with JP 9131260, sea water is passed through a nanofiltration film to lower the concentration of sulfate ($SO_4^{2-}$) ion. The treated water is then passed through a RO membrane. In accordance with the JP reference as well as with Hassan, 100% of the feed is subjected to a nanofiltration pretreatment prior to being fed to a desalination unit. In response to Applicant's remarks in the Amendment, filed December 31, 2001, the Examiner withdrew the claim rejections based on JP 9131260. Applicant submits, therefore, that the §102 rejection based on Hassan should be withdrawn for the same reason that the rejection based on JP 9131260 was withdrawn.

Anticipation requires that each and every element be disclosed is a single prior art reference. Hassan teaches that 100% of the NF permeate is used as the make-up or feed to a desalination system. As such, Hassan does not disclose a desalination process using a blend or variable percentage of make-up. Therefore, withdrawal of the §102 rejection based on Hassan is requested.

**IV. Claim Rejections – 35 U.S.C. §103**

Claims 2, 9 and 10 are rejected as being unpatentable over Hassan in view of Al-Sofi, Mohammad A.K., et al., "Nanofiltration as a means of achieving higher TBT of ≥ 120oC in MSF", Desalination 118 (1998) 123-129 ("Al-Sofi").

Al-Sofi is a report on the results of a pilot plant study based on the process described in Hassan. As such, Al-Sofi is premised on the norm that 100% NF permeate is used as the feed to the desalination system. Therefore, the combination of Hassan and Al-Sofi cannot suggest or demonstrate, as in the present application, the economic advantages which are possible with the claimed invention when only a portion of the feed is treated, i.e., a more cost-efficient operation of desalination plants and a reduction on the energy consumption of such plants without sacrificing yield or TBT.

Withdrawal of the rejection based on Hassan and Al-Sofi is requested.

## CONCLUSION

Upon entry of this Amendment, claims 1-18 and 24-29 are pending. Applicants respectfully submit that claims 1-18 and 24-29 are directed to patentable subject matter. Accordingly, Applicants request allowance of the claims.

Authorization is hereby given to charge any fee in connection with this communication to Deposit Account No. 23-1703.

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Respectfully submitted,

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Enclosure: Wensley, A.G., et al., "Ion Selective Membranes: A Presoftening Process for Seawater Distillation", Proceedings of the 7th International Symposium on Fresh Water from the Sea, vol. 1, pp. 417-426 (1980)